Math 31L Lab Quiz #4

Blake, Fall 1997

Name: _____

Consider the differential equation, $W'(t) = \mu W(t) - E$, which models the net worth of a company.

1. (5 points) What does μ represent? [Pick one answer below.]

   (a) The growth rate of the economy.

   (b) The initial value of W.

   (c) The interest the company must pay on borrowed funds.

   (d) The steady state value of W.

2. (5 points) What does the E represent?   [Pick one answer below.]

   (a) The initial capital required to insure that the net worth will approach an Equilibrium.

   (b) The annual Expenses.

   (c) The amount of Energy required to achieve a positive rate of growth.

   (d) The annual Earned income of the company.

   (5) Extraneous capital.

3. (5 points) In the case that μ and E are constant, what is the significance of the number $\frac{E}{\mu}$?

   [Pick one answer below.]

   (a) It is the number of years required for the company to break even on its initial investment.

   (b) The value of $W'(t)$ will always be between $-\frac{E}{\mu}$ and $\frac{E}{\mu}$.

   (c) The initial capitalization must be at least $\frac{E}{\mu}$ to ensure continued growth.

   (d) It is the scientific representation of the emu.

4. (6 points) To create the approximations below, the same value was used for E in each graph, and the same value was used for $W(0)$ in each graph. Match each choice of μ below with the appropriate Euler's method plot of $W(t)$.

   (a) $\mu = .04$ (b) $\mu = .04 + (.03)sin(\frac{t\pi}{2})$ (c) $\mu = .04 + (.03)sin(\frac{t\pi}{2} + \pi)$

The last question is on the back.

5. (9 points) Consider the differential equation

$$W'(t) = \mu(t)W(t) - 300, \qquad W(0) = 8000.$$

Assume that $\mu(t) = .04 + (.03)\cos\left(\frac{t\pi}{2} + \pi\right)$. Suppose we use Euler's method with $\Delta t = .2$ to generate approximate values of $W(t)$. Compute the approximation for $W(.4)$. You must show each step of your work clearly.